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Magnesium-Lithium Alloys Developed for Low Temperature Use

Three new magnesium-lithium alloys have been developed for application at cryogenic temperatures (down to -423°F). These lightweight alloys have approximately double the tensile and yield strengths (at room temperature) of the LA 91A, LA 141A, and LAZ 933A magnesium-lithium alloys described in NASA SP-5068, "Properties and Current Applications of Magnesium-Lithium Alloys" (for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402; price: 40 cents). The designations and nominal compositions of the new alloys are:

Alloy II4: Mg, 7Li, 1Zr, 3Th, 6Zn, 5Cd, 6Ag

Alloy IA6: Mg, 9Li, 3Th, 2Zn, 4Al, 4Ag, 1Mn

Alloy ZLH 972: Mg, 7Li, 9Zn, 2Th

Alloy II4, as rolled initially at 675°F for ingot breakdown followed by finish rolling at 450°F , or as solution heat-treated at 650°F followed by thermal stabilizing aging at 150°F , exhibits at 68°F tensile strengths in excess of 45,000 psi, yield strengths of more than 35,000 psi, and minimum ductility values of 15 percent. The strength values are increased at -452°F , with a reduction in ductility to a minimum of 8 percent. Alloy IA6, after rolling at 260°F , followed by solution heat treatment at 600°F , water quenching, and then aging at 200°F , exhibits similar strength properties. However, the long aging times needed to obtain the 15 percent and 8 percent ductilities at 68° and -452°F , respectively, for this alloy often result in strength degradation. Alloy ZLH 972,

when rolled at 450°F , heat treated at 600°F , quenched and aged at 200°F , has satisfactory strength and ductility properties, but is sensitive to embrittlement and has a tendency toward hot shortness at the usual hot working temperatures (600° to 675°F). The alloys are easy to weld by the conventional TIG method, are readily machinable and chemically millable, and respond well to conventional metal forming operations (except that ZLH 972 is not readily extruded). The notched/unnotched tensile ratios for each of the alloys are 1.0 and 0.9 at 68° and -452°F , respectively.

Note:

Inquiries concerning these alloys may be directed to:

Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama 35812
Reference: B67-10365

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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